

**CLAIMS**

What is claimed is:

1. A semiconductor-on-insulator (SOI) structure having;  
a semiconductor substrate;  
a leaky, thermally conductive insulator material (LTCIM) layer disposed on the semiconductor substrate; and  
a semiconductor layer disposed on the LTCIM layer; and  
active regions defined in the semiconductor layer by isolation trenches and the polysilicon layer.
2. The SOI structure according to claim 1, wherein the semiconductor substrate material is silicon (Si), silicon carbide (SiC), silicon germanium (SiGe) or any other semiconductive material.
3. The SOI structure according to claim 1, wherein the LTCIM layer has a thermally conductivity value between about 30 W/mK to about 170 W/mK.
4. The SOI structure according to claim 1, wherein the LTCIM layer is silicon.
5. The SOI structure according to claim 4, wherein the silicon layer preferably has a resistivity value 10  $\Omega$ -cm or greater.
6. The SOI structure according to claim 4, wherein the silicon layer is single crystalline silicon.
7. The SOI structure according to claim 6, wherein the single crystalline silicon layer is undoped.

8. The SOI structure according to claim 4, wherein the silicon layer is porous silicon.

9. The SOI structure according to claim 8, wherein the porous silicon layer is undoped.

10. The SOI structure according to claim 4, wherein the silicon layer is amorphous silicon.

11. A method of fabricating a semiconductor-on-insulator (SOI) structure, the method comprising the steps of:

depositing a leaky, thermally conductive material (LTCIM) layer on a first semiconductor substrate;

depositing an LTCIM layer on a second semiconductor substrate;

placing one of the semiconductor substrates on top of the other semiconductor substrate such that the LTCIM layer on the first semiconductor substrate is in contact with the LTCIM layer on the second semiconductor substrate;

removing a substantial portion of one of the semiconductor substrates leaving a thin semiconductor layer; and

repairing an exposed surface of the thin semiconductor layer.

12. The method according to claim 11, wherein the step of removing a substantial portion of one of the semiconductor substrates includes the steps of;

creating a zone of weakness under a surface of one of the semiconductor substrates; and

breaking the zone of weakness on the one semiconductor substrate.

13. The method according to claim 12, wherein the step of repairing the exposed surface results from breaking of a zone of weakness formed within one of the semiconductor substrates.

14. The method according to claim 13, wherein the step of repairing the exposed surface includes;

polishing the surface in order to remove residual damage.

15. The method according to claim 11, includes the additional step of; fusing the LTCIM layer of the first semiconductor substrate with the LTCIM layer of the second semiconductor substrate.

16. The method according to claim 15, wherein the step of fusing includes;

heating the SOI structure until the LTCIM layer of the first semiconductor substrate and the LTCIM layer of the second semiconductor substrate are fully fused.

17. A semiconductor-on-insulator (SOI) structure having;  
a semiconductor substrate;  
a leaky, thermally conductive material (LTCIM) layer disposed on the semiconductor substrate;  
a semiconductor layer disposed on the (LTCIM) layer;  
a gate defining a channel interposed between a source and a drain formed within an active region of the SOI structure; and  
the active region defined in the semiconductor layer by isolation trenches and the LTCIM layer.